

1,3-Dichloropropene (Telone): Protecting Bystander & Worker Health

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Summary

Background: The California Department of Pesticide Regulation (CDPR) evaluates worker and bystander exposure to the methyl bromide alternative: 1,3-dichloropropene (1,3-D also known commercially as Telone®). 1,3-D is a volatile organic compound (VOC) that has been registered for use as a pesticide to control symphylans, wire worms and all major types of nematodes since 1954. In 1990, California suspended all use because unacceptably high levels of 1,3-D were detected in its air monitoring program. 1,3-D use in California was reinstated in 1995 following label changes and mitigation measures aimed at reducing exposures of workers and bystanders.

Reported Illnesses: In California, reports of illness and injury associated with pesticides are maintained in the Pesticide Illness Surveillance Program (PISP). Exposure to 1,3-D vapor and liquid leads to irreversible eye damage. Inhalation causes severe irritation of the nasopharynx and lungs and may lead to central nervous system depression, loss of consciousness, and convulsions. Skin contact causes dermatitis and necrosis and leads to persistent sensitization. 1,3-D causes tumors in animals. Illness information, coupled with the physical and chemical properties of 1,3-D, is used to develop criteria for mitigation including personal protective equipment designed to be health protective.

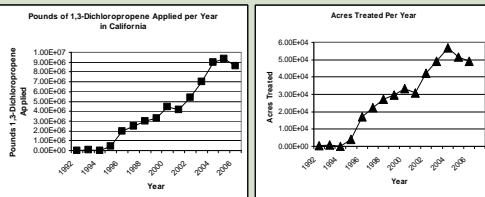
Pesticide Use: California collects data on all agricultural pesticides applied by licensed applicators in the Pesticide Use Report (PUR) database (<http://www.cdpr.ca.gov/docs/pur/purmain.htm>). 1,3-D containing pesticides are California Restricted Materials and may be applied only by certified applicators. The PUR database provides a summary of trends in use patterns. The PUR database shows that pounds of 1,3-D applied increased 21-fold between 1995 and 2006 (the latest year for which data are available). Along with this increase, there was also a 12-fold increase in the number of acres treated per year, and an increase in the average number of pounds of 1,3-D applied per acre. In 2006 in California, 167 million pounds of pesticide active ingredients (AIs) were used for agricultural production and 1,3-D accounted for 8.6 million pounds or 5.1%. The most recent 5 years (2002 to 2006, currently) are averaged to minimize yearly variations. This averaged data is then analyzed to determine monthly use by county. For 1,3-D the high-use season (defined as those months in which the pounds used are equal to or exceed 5% of the total annual county use) varies from 5 to 8 months for the top use counties of: Fresno, Kern, Merced, Monterey, Tulare, Stanislaus, Ventura, and Imperial. Some counties, such as Merced and Ventura, show non-overlapping periods of high use. In some high use counties, the application rate approaches the maximum (332 pounds per acre) allowed by the label for shank application.

Patterns of Crop Use: Maximum application rates and methods vary depending on the crop. Between 2002 to 2006, the sites with the highest average total pounds of 1,3-D applied were (in declining order): tree crops, strawberries, carrots, grapes, and sweet potatoes. These same crops, albeit in a different order, accounted for the highest average number of acres cultivated (in declining order): strawberries, carrots, tree crops, sweet potatoes, and grapes).

Application methods for 1,3-D include: broadcast shank (shallow or deep and tarped or non-tarped), bedded shank (tarped or non-tarped), prebed application with tarp, surface drip with tarp, buried drip (non-tarped), and tree replant wanding. Air monitoring studies (often coupled with computer modeling of air monitoring data) are used to define off gassing rates for exposure estimates. Data for these calculations are provided by registrant studies and the open scientific literature. Also, CDPR may undertake studies to collect data for specific application methods (Wofford *et al.*, 2005).

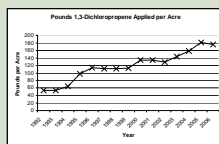
Thus, data from many sources are used to develop exposure assessments for fumigants like 1,3-dichloropropene.

Annual Use of 1,3-D in California Is Increasing (1992-2006)



The use of 1,3-D has been increasing both terms of the pounds applied per year and the number of acres treated per year.

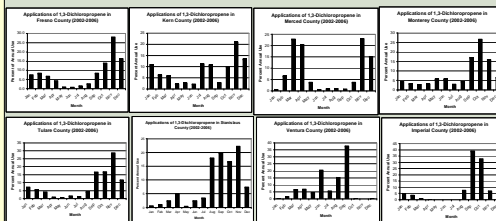
Overall Increase in Application Rate Since 1992



Although both the pounds applied and the number acres treated per year have been increasing since 1992, the net effect has been an increase in the pounds applied per acre. In California the maximum use allowed by label specifications is 332 pounds/acre for shank application and 252 pounds per acre by drip application. Many applications are approaching these limits. Earlier exposure assessments (Sandborn and Powell, 1994) assumed an application rate of 118 pounds per acre. Given the increase in pounds applied per acre, application rates used in exposure assessments should reflect this increase.

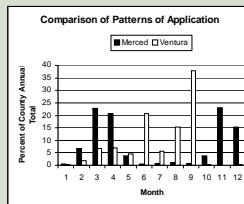
Patterns of Seasonal Use Vary in Top 1,3-D Using California Counties

The top use counties in terms of 1,3-D used per year (averaged over the period from 2002-2006) range from 5.59 to 2.72 million pounds per county per year. These counties (in decreasing order of pounds applied) are: Fresno, Kern, Merced, Monterey, Tulare, Stanislaus, Ventura, and Imperial.



For the purpose of exposure assessment, the high use season for 1,3-D in a county includes all those months in which the pounds applied are greater than or equal to 5% of the total pounds applied in that county per year. As seen in the eight figures above, the high use season in the counties shown varies from 5 to 8 months. The seasonal pattern of high use varies among counties. A given seasonal pattern for a county is applicable to workers and bystanders who remain in that county. However, many applicators work in several counties. For those workers, the high use season could be even longer as illustrated in the figure below.

Some Counties Show Non-Overlapping High Use Seasons



As shown in the figure above, some counties such as Merced and Ventura have non-overlapping high use seasons. If workers travel between these two counties, the high use season for applicators and possibly occupational bystanders could be as long as 9 months. These extended high use seasons call into question earlier exposure estimates that assumed a 90 day high use seasons with 18 days per year exposure for applicators (Sandborn and Powell, 1994; DPR, 1997). A more recent, interim update of applicator seasonal exposure estimated a 6 week period of continuous high use for a total of 42-48 days per year (Powell, 2004). However, given the seasonal use patterns shown above, the limited number of applicators in California, and the tendency of applicators to work throughout the state, even the interim estimates may underestimate the seasonal exposure for applicators and their associates.

Personal Protective Equipment for 1,3-Dichloropropene Applicators

Given the extended length of seasonal applications, personal protective equipment is important. Required protective equipment for persons who may have with direct contact with 1,3-D includes:



- Coveralls over short-sleeved shirt & short pants
- Chemical resistant gloves
- Chemical resistant footwear & socks
- Face sealing goggles/full face respirator
- Chemical resistant head gear (*for overhead exposure*)
- Chemical resistant apron
- Respirator with organic vapor removing cartridge (*TC-23C*) or pesticide-approved canister (*TC-14G*)

Application Methods Which Reduce 1,3-D Off-Gassing Are Important for Mitigating Bystander Exposure



1,3-Dichloropropene is a Toxicity Category II pesticide based on its acute toxicity by oral and inhalation routes. 1,3-D is a probable human carcinogen. It spreads by volatilization and diffusion in the vapor phase following pre-plant fumigation.



Different application methods for 1,3-D have dramatic effects on flux rates. Air monitoring studies, coupled with computer modeling of air monitoring data, are used to define off gassing rates for exposure estimates. Data for these calculations are provided by registrant studies and the open scientific literature. The ability of various types of tarping materials and methods are of special interest to DPR Worker Health and Safety in order to define ways to mitigate exposure to 1,3-D and other fumigants.



On occasion, DPR may undertake studies to collect data for specific application methods (Wofford *et al.*, 2005). The flux rates following "Rototill and Roll" application of 1,3-D followed by Metam Sodium is one such study. Wofford *et al.* (2005) monitored this method as used for Easter lily production in Del Norte County. Rototill and Roll is illustrated by the photos on the left.



In Rototill and Roll 1,3-D is first applied by 18-inch shank injection followed immediately by a ring roller to fill in the shank tracks. Metam sodium is applied by a second tractor using spray application to the surface followed by a rototill attachment to "bury" the Metam closer to the surface than the 1,3-D. Following the rototill (and attached to the same tractor) is a heavy roller than packs the surface tightly. This tight packing reduces pesticide flux.



References Cited

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